

### Claims

What is claimed is:

1. A method of making a high temperature superconducting composite comprising the steps of  
providing a reticulated foam structure comprising a metal selected from the group  
consisting of silver, silver alloy, gold and gold alloy, the reticulated foam structure having  
continuous ligaments defining a plurality of continuous open cells,  
filling the continuous open cells of the reticulated foam structure with a high  
temperature superconducting ceramic oxide or precursor,  
compacting the filled structure, and  
heating the compacted structure to melt and/or texture the high temperature  
superconducting ceramic oxide or precursor to form a continuous region of high temperature  
superconducting ceramic oxide throughout the compacted structure.
2. A method of making a composite superconducting conductor comprising the steps of  
providing a reticulated foam structure made of a metal selected from the group  
consisting of silver, silver alloy, gold and gold alloy, the reticulated foam structure having  
continuous ligaments defining a plurality of continuous open cells,  
enclosing the reticulated foam structure in a sheath,

filling the continuous open cells of the enclosed reticulated foam structure with a superconducting ceramic oxide or precursor,

compacting the sheath, thereby compacting the enclosed filled reticulated foam structure,

heating the compacted sheath to melt and/or texture the compacted superconducting ceramic oxide or precursor to form a composite superconducting conductor having a continuous region of superconducting ceramic oxide throughout the enclosed, compacted reticulated foam structure.

3. The method of claim 2, wherein the step of compacting the sheath involves forming the sheath into a wire.

4. The method of claim 2, wherein the step of compacting the sheath involves forming the sheath into a rod.

5. The method of claim 2, wherein the step of compacting the sheath involves forming the sheath into a tape.

6. The method of claim 2, wherein the reticulated foam structure is a silver-palladium alloy.

7. The method of claim 6, wherein the silver-palladium alloy comprises at least about 80 % silver by weight.

8. The method of claim 6, wherein the silver-palladium alloy comprises at least about 90 % silver by weight.

9. The method of claim 2, wherein the reticulated foam structure has a relative density of from about 5 % to about 55 % of that of bulk non-superconducting metal of the same

composition.

10. The method of claim 2, wherein the reticulated foam structure has a relative density of from about 10 % to about 30 % of that of bulk metal of the same composition.
11. The method of claim 2, wherein the reticulated foam structure is characterized as having from about 5 to about 80 pores per inch.
12. The method of claim 2, wherein the high temperature superconducting ceramic oxide or precursor before the heating step is in the form of a powder.
13. The method of claim 2, wherein the high temperature superconducting ceramic oxide or precursor before the heating step is in the form of a slurry.
14. The method of claim 2, wherein the high temperature superconducting ceramic oxide is selected from the group consisting of bismuth - based superconducting ceramics, thallium - based superconducting ceramics, yttrium - based superconducting ceramics, and mercury - based superconducting ceramics.
15. The method of claim 2, wherein the high temperature superconducting ceramic oxide is selected from the group consisting of  $\text{Bi}_2\text{Sr}_2\text{Ca}_1\text{Cu}_2\text{O}_y$ ,  $\text{Bi}_2\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_y$ ,  $\text{Y}_1\text{Ba}_2\text{Cu}_3\text{O}_y$ ,  $\text{Tl}_2\text{Ba}_2\text{Ca}_2\text{Cu}_3\text{O}_y$ ,  $\text{Tl}_1\text{Ba}_2\text{Ca}_2\text{Cu}_3\text{O}_y$ ,  $\text{Hg}_1\text{Ba}_2\text{Ca}_2\text{Cu}_3\text{O}_y$  and  $\text{Hg}_1\text{Ba}_2\text{Ca}_1\text{Cu}_2\text{O}_y$ .
16. The method of claim 2, wherein the reticulated foam structure has a cylindrical shape, wherein the sheath is a tube having a sealed end, and wherein the outer diameter of the reticulated foam structure is approximately equal to the inner diameter of the tube.
17. The method of claim 2, wherein the sheath is made of a metal having the same composition as that of the reticulated foam structure.

18. A high temperature superconducting composite made by a process comprising the steps of

providing a reticulated foam structure comprising a metal selected from the group consisting of silver, silver alloy, gold and gold alloy, the reticulated foam structure having continuous ligaments defining a plurality of continuous open cells,

filling the continuous open cells of the reticulated foam structure with a high temperature superconducting ceramic oxide or precursor,

compacting the filled structure, and

heating the compacted structure to melt and/or texture the high temperature superconducting ceramic oxide or precursor to form a continuous region of high temperature superconducting ceramic oxide throughout the compacted structure.

19. A high temperature superconducting composite conductor made by a process comprising the steps of

providing a reticulated foam structure made of a metal selected from the group consisting of silver, silver alloy, gold and gold alloy, the reticulated foam structure having continuous ligaments defining a plurality of continuous open cells,

enclosing the reticulated foam structure in a sheath,

filling the continuous open cells of the enclosed reticulated foam structure with a superconducting ceramic oxide or precursor,

compacting the sheath, thereby compacting the enclosed filled reticulated foam structure,

heating the compacted sheath to melt and/or texture the compacted superconducting

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ceramic oxide or precursor to form a composite superconducting conductor having a continuous region of superconducting ceramic oxide throughout the enclosed, compressed reticulated foam structure.

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